

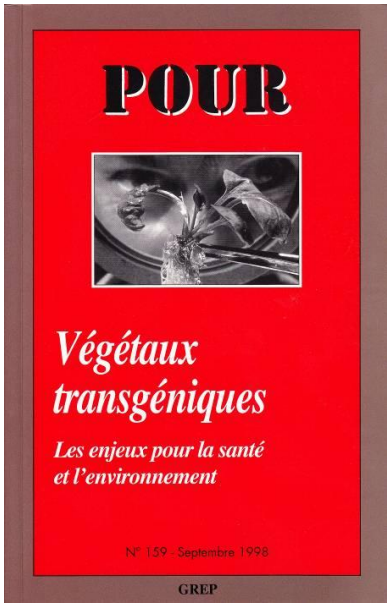
18 September 2014, UEAA, Prague  
'Utilization of GMO in Agriculture' workshop

# The Political Situation in France and the French Research Programs on GMOs

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and Deputy Secretary of Life Sciences Sections

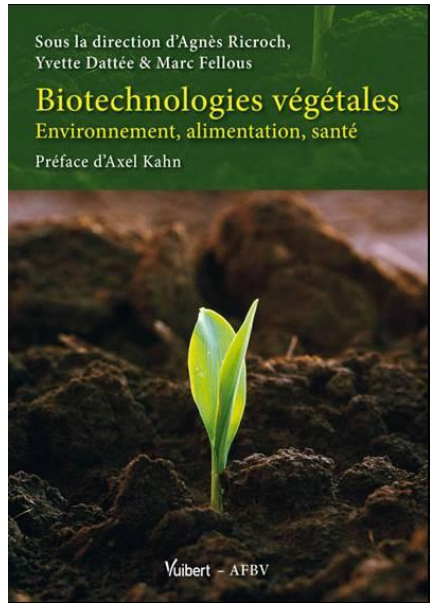
Associate Professor in Genetics and Plant Breeding, AgroParisTech, France  
Adjunct Professor, Pennsylvania State University, USA



1998



2006



2011



2014

# **1. The Political Situation in France**

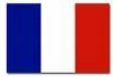
France cultivated Bt Mon810 maize from 2005 to 2007.

	<b><u>2006</u></b>	<b><u>2007</u></b>
1. Spain	54,000	75,000
2. France	5,000 (500 in 2005)	21,200
3. Czech Republic	1,290	5,000
4. Portugal	1,250	3,000
5. Germany	950	2,650

**French bans in January 2008, February 2012, March 2014.**

	<b><u>2008</u></b>
1. Spain	79,269
2. Czech Republic	8,380
3. Romania	7,146
4. Portugal	4,851
5. Germany	3,173
6. Poland	3,000
7. Slovakia	1,900

# The Successive Bans of The French Government on cultivation of MON 810 maize varieties



- 8 January 2008                      Nicolas Sarkozy's government
- 20 February 2012                  Nicolas Sarkozy's government
- 24 March 2014                      François Hollande's government



**EFSA** concludes that **no scientific data specifically in terms of risks to the environment was provided by the French authorities to justify the invocation of the safeguard clause.**

- 27 Feb., 29 Oct. 2008      EFSA Journal 2008 850, 1-46
- 21 May 2012                      EFSA Journal 2012 10(5), 2705
- 1st August 2014                  EFSA Journal 2014 12(8), 3809

# French and other German, Italian... bans politically motivated.

The French government invoked alleged data on a potential environmental impact to ban.

Ricroch, Berge & Kuntz (2009). Is the German suspension of MON810 maize cultivation scientifically justified? *Transgenic Research*. (2010) 19, 1, 1-12.

online 23 June 2009 <http://www.springerlink.com/content/r6052757667ng364/fulltext.pdf>

Kuntz, Davison & Ricroch (2013). What the French ban of Bt MON810 maize means for science-based risk assessment. *Nature Biotechnology*, 8 June, 31, 498-500 [doi:10.1038/nbt.2613](https://doi.org/10.1038/nbt.2613)

**A recent French law prohibits the  
cultivation of GM maize varieties.**

on 2 June 2014

JORF n°0127 du 3 juin 2014, 9208.

## **2. French Research on GMOs or using GMOs**

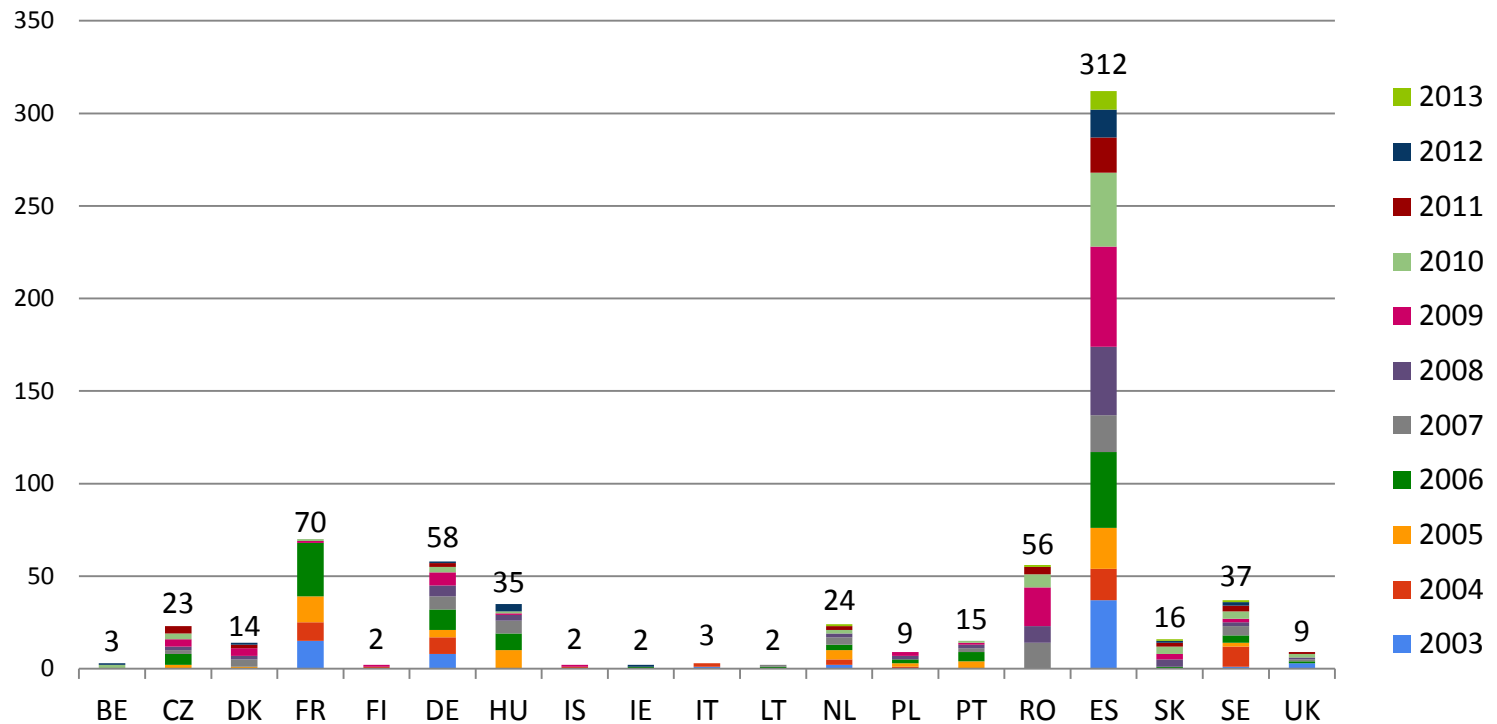


Since 2008 the **High Council of Biotechnology** (HCB, Haut Conseil des biotechnologies) delivers opinions on GM field trials and confined research. This council advises the French government.

The **Biomolecular Engineering Committee** (CGB, Commission du génie biomoléculaire) preceded the HCB from 1998 to 2008.

## **2.1 Field trials of GM plants**

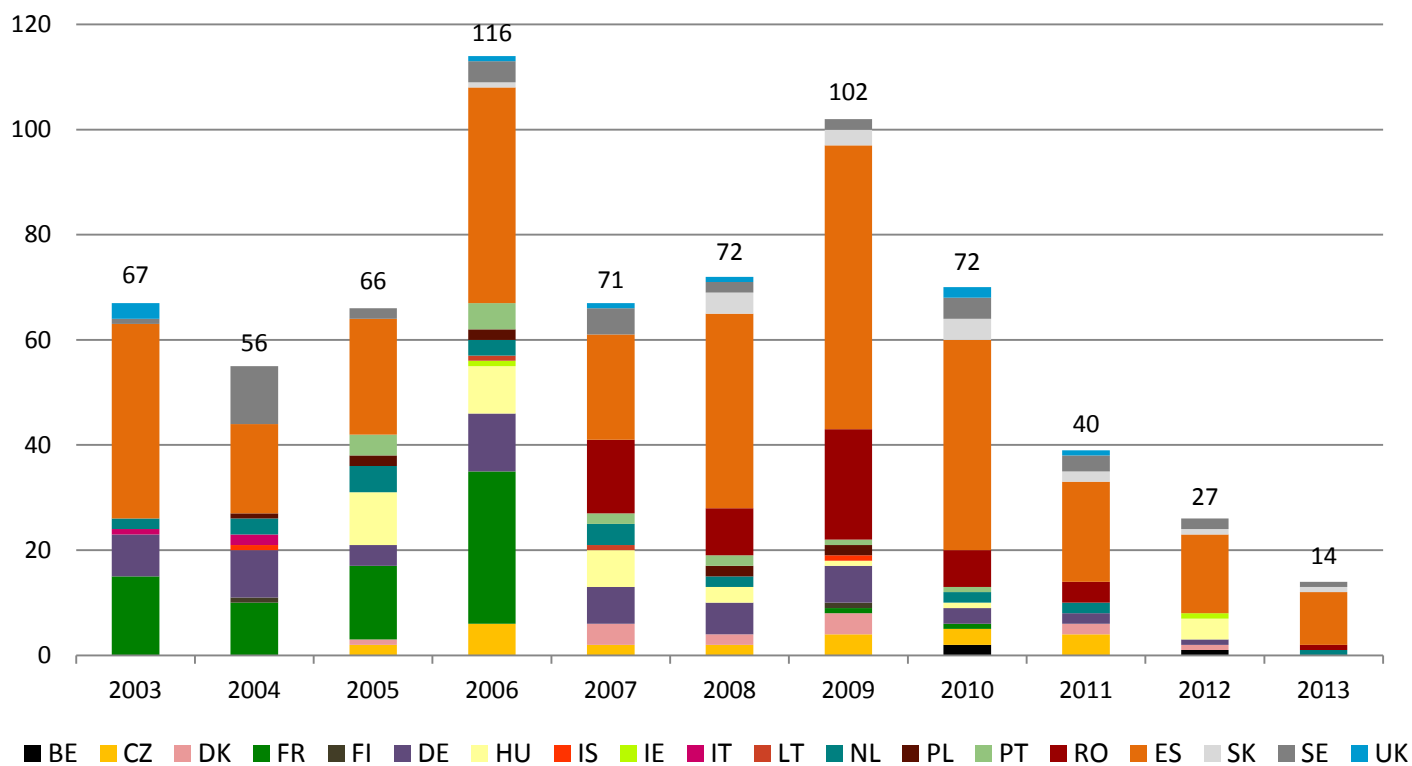
## Number of GMO trials per country per year between 2003 and 2013



France implemented numerous GMO trials before bans. **No trial in 2014.**

Spain is indisputably the country most involved in GMOs trials in EU.

## Number of GMO trials per year per country between 2003 and 2013 (834 field trials)



The number of GMO trials in EU is decreasing since 2009.

Some European companies have relocated part of their R&D to countries in which these new technologies are exploited and with no vandalism of fields.

# Field public trial vandalism

- On 5 September 2009, a field trial of GM grapevine, intended to resist the grapevine fanleaf virus, was plundered by an individual at the INRA center in Colmar (Alsace), despite an ongoing process of dialog with stakeholders (including environmental organizations), which was meant to “co-construct” this experiment\*.
  - On 15 August 2010, the same trial was implemented again in Colmar, but, 62 persons, after having cut the fence, entered the experimental plot and tore out the 70 vines. The damage was estimated at €1,200,000.
- \* A participative experiment designed by sociologists, involving stakeholders, which was nevertheless vandalized twice.

## **Abstract**

About 80 acts of vandalism against academic or governmental research on GMOs are identified, mainly in 4 countries; namely France, Germany, the United Kingdom and Switzerland. Examples are also provided for Italy and Belgium.

Source: Kuntz 2012 Destruction of public and governmental experiments of GMO in Europe. *GM Crops Food*. 2012 Oct-Dec;3(4):258-64.

Communiqué de presse

28 May 2014

**Suites judiciaires de la destruction d'un essai scientifique en plein-champ**

12 July 2014

**Programme de recherche sur les biotechnologies végétales**

## 2.3 Research programs

See <http://www.gisbiotechnologiesvertes.com/en/presentation-du-gis-bv>

# What are the main agricultural challenges encountered by the French farmers?

The main agricultural challenges are biotic stresses.

Countries	France
Species (ha)	
wheat	(1) 5 430 000 (F/D/ <b>NUE</b> /Y)
barley	(3) 1 600 000 (F/I/D/Y)
maize	(2) 2 980 000 (F/ I/ <b>D</b> / Y)
OSR	(4) 1 580 000 (F/I/D/ <b>NUE</b> )
grapevine	(5) 900 000 (F/ V)
potato	120 000 (F/N/V)
beet	370 000 (F/ V/ Y)
sunflower	380 000 (F/ PP)
olive tree	47 000 (I)
other fruit trees	134 000 (V)
rice	23 828 (F/ I)
soybean	50 939 ( <b>NUE</b> )

First crop  
Second  
Third  
Fourth  
Fifth

Stress  
biotic

Stress  
abiotic

Trait  
to breed

B: bacterial disease
F: fungal disease
I: insect pest
N: nematode
V: virus
PP: parasitic plants such as Orobanche (broomrape)
W: weed
C: cold/ frost
D: drought
L: logging
NUE: Nitrogen Use Efficiency
Y: yield



# Is transgenesis in plants used in basic research and/or to create new varieties?

- **Basic research**                      Public research uses transgenesis
- **Creation of new varieties**                      No
- **Comments**                      The private sector performs its field trials of GM plants mainly in the USA due to vandalism.

# Transgenesis is used in research or by the private sector.

<b>Barley</b>	Possible development of resistant varieties using transgenesis. Biotic stress Powdery mildew ( <i>Erysiphe graminis</i> ), basic research, T.
<b>Maize</b>	Abiotic Stress: to create new varieties with a high NUE and WUE, T. Collaboration with Biogemma. First GM plants trials in the USA.
<b>Oilseed rape</b>	Nutritional Value Improvement of oil yield. GM plants assessed for pressing capacity of the seeds. T.
<b>Grapevine</b>	Vandalism. Only one program in progress (virus resistance).
<b>Plum tree</b>	Biotic Stress: plum Pox Virus.
<b>Poplar</b>	For wood properties and bioenergy production. Trials (agronomical and environmental assessment), T. <b>Destruction by Inra in July 2013</b>

# Is France developing specific breeding techniques\*?

**Some research programs use genetic engineering.**

**SNP and QTL** used.

**ODM** not tested or developed.

**Meganucleases and TALEN** (and also transgenesis)

tested on wheat, maize, rice, OSR, tomato, potato, poplar, apple, *Brachypodium*.

are developed in basic research mostly for proof of concept ('Genius' program).

\* such as Agro-infiltration, Cisgenesis, Intragenesis, MAS (Marker-Assisted Selection: SNP (Single Nucleotide Polymorphism) and QTL (Quantitative Trait Loci)), ODM (Oligonucleotide Directed Mutagenesis), RNA-dependent DNA methylation (RdDM), Reverse Breeding, or ZFN (Zinc Finger Nuclease Technology) and other nucleases (meganucleases and TALEN, Transcription activator-like effector nuclease)

# GENIUS (*Genome ENgineering Improvement for Useful plants of a Sustainable agriculture*)

- Optimize existing transgenesis protocols
- Develop new technologies (nucleases) in partner labs
- Explore novel ways of transgenesis
- Allow French researchers to maintain high level technical know-how and expertise in the field of genome engineering.

<http://www.genius-project.fr/en/project/presentation>

## Key numbers

**Duration:** September 1<sup>st</sup>, 2012 to December 31<sup>st</sup>, 2019  
(7 years and 4 months)

**Funding:** 6 M€ by the Investment for the Future ANR program "Biotechnology and Bioresources" for a total cost of 21.3 M€.

**Partnership:** 89 permanent scientists in 19 research labs belonging to 8 institutions/companies.

# Partnership

- 10 public partners

INRA (8 units) : fundamental biological research/ human and social sciences

CIRAD : fundamental biological research

Lyon3 University : human and social sciences

- 5 private partners

Collectis : nucleases use and design

Biogemma : biotech subsidiary of seed companies (in GENIUS: wheat and maize)

Germicopa : potato breeding

Delbard : rose and apple breeding

Vilmorin & Cie : multi-species breeding (in GENIUS: legal issues)

# Basic Research Public Programs

## On-going National Programs

1. **CRYMUC:** to assess interactions of insecticidal toxins Cry with mucus from the gut (2011-14).
2. **DISTRACO:** to measure gene flow (pollen and seeds) in oilseed rape fields (no GM OSR used) (2011-14).
3. **GMO90plus:** to improve the 90 day subchronic toxicology study in rats by taking advantage of the most advance concepts and technologies in order to optimize its predictive character (2014-17).

financed by the Ministry of Ecology, Sustainable Development and Energy (MEDDE) ecology under the frame 'RiskOGM'.

# Basic Research Public Programs

## On-going European Programs

### **GRACE (2012-15)**

is an EU FP7 research project with two key research objectives: Assessing health, environmental and socio-economic impacts of GM plants (risks and benefits) and testing various types of animal feeding trials and alternative in-vitro methods for health risk assessments of GM food and feed.

### **MARLON (2012-15)**

Monitoring of Animals for Feed-related Risks in the Long Term. to create an inventory of which epidemiological and monitoring initiatives exist, both within and outside the EU, which could provide useful data for the purpose of monitoring for health impacts of animal feeds, in particular those containing GM ingredients, on livestock animals .

### ***GMSAFood (3.420.000 € ; 2010-12, ended)***

*was set up to develop a strategy for post market monitoring for GMOs.*

# Movements of scientists and patents

- Dr Catherine Feuillet (wheat breeder) moved to Bayer CropScience, NC, USA (Head of Trait Research).
- Dr Marc Fuchs (developed GM virus-resistant grapevine) moved to Cornell Univ., USA
  - loss of leadership of France in GE on grapevine
  - new leadership of the U.S. and China



Some European companies have relocated part of their R&D to countries in which these new technologies are exploited: KWS, Limagrain-Vilmorin, Bayer CropScience, BASF ...

- **Private company Florimond Desprez: GM trials in Argentina**
- **Cooperative Limagrain-Vilmorin: GM trials in the USA**

## **‘Genetically engineered crops’ think-tank of the French Academy of Agriculture, 2013-14**

A **colloquium** on 12 December 2013 on GE crops was organized by 3 Academies (Sciences, Technologies and Agriculture).

See summary of the **report** on GE Crops and supplementary information (January 2014) at:

<http://www.academie-agriculture.fr/groupes-de-reflexion/plantes-genetiquement-modifiees>

## 2.4 Research programs using GM animals

- In France scientists can produce GM animals for basic and medical research as well as for applications in the medical and pharmaceutical fields.
- They cannot do anything in the agricultural field, so no GM farm animals produced.
- The species concerned for basic research including models of human disease are mice, rabbit, rat, goat, fruit flies, zebrafish.

# Model of Transgenic Rabbit

- to produce molecules for body weight loss \*
- to study cystic fibrosis and diabetes

\* Jolivet et al. (2014) Induction of Body Weight Loss through RNAi-Knockdown of APOBEC1 Gene Expression in Transgenic Rabbits. PLoS ONE 9(9): e106655. doi:10.1371/journal.pone.0106655

and

\* Masson et al. (2012). Worsening of Diet-Induced Atherosclerosis in a New Model of Transgenic Rabbit Expressing the Human Plasma Phospholipid Transfer Protein. *Arterioscler Thromb Vasc Biol* is available at <http://atvb.ahajournals.org> DOI: 10.1161/ATVBAHA.110.215756

# Model of Transgenic Mice

- Production of transgenic mice stably expressing siRNA targeting the gene of the pseudorabies virus which infects mice and farm animals \*.
- Pigs cannot be used as producing GM pigs is not allowed.

\* Daniel-Carlier et al. (2013) Viral infection resistance conferred on mice by siRNA transgenesis. *Transgenic Res* 22:489–500

# Model of Transgenic Goat

for the study of sex determination.

# Conclusion

- Due to political situation or economic limit, research efforts are only restricted to a few crops and agricultural challenges.
- In France, funding for public research programs using GE is limited. The political context in Europe, allegedly based on the precautionary principle, is currently blocking research using GEs (field trials), and consequently potential solutions to address farmer and consumer's challenges.
- Programs on GM crops or using GMOs as model animals for human and animal diseases are basic research.



**Thank you for your kind attention.**

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